# PRACTICAL OBSERVATIONS

ON THE MEANS OF

# Detecting Dhatoora & Aconite

WHEN IT HAS BEEN

ADMINISTERED WITH THE INTENTION OF INDUCING
STUPEFACTION, INTOXICATION, OR DEATH.

BY

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# PRACTICAL OBSERVATIONS

## ON THE

# MEANS OF DETECTING DHATOORA.

Dhatoora, or, as is spelt in European books, Datura, is perhaps the most commonly used vegetable poison in India. The mere fact of a whole tribe being called Dhaturias, because they committed their depredations while their victims were drugged with this poison, indicates the frequency of its use.

The dhatoora plant grows by every roadside in most parts of the country; it may be everywhere found, both in flower and fruit, at all seasons of the year; when the seeds of the most common species, *viz.*, white dhatoora, or Datura metel, are boiled with rice, they appear in the midst of the white mass as yellowish pear or kidney-shaped bodies, so nearly resembling capsicum seeds, which are used with the rice as a condiment, that they excite little suspicion, either by their appearance or taste, for they have very little flavour. The following case affords a fair illustration of a common mode of administering the drug, and also of the means by which it may be detected when the seeds are swallowed whole, that is, in the simplest form of dhatoora poisoning.

Early in the morning of the 3rd September, 1865, the bodies of two men were observed lying under a peepul tree near Futtehpore, in Zillah Tirhoot; on examination, one was found to be dead, the other only in a state of insensibility; when, after a time, the latter became conscious, he stated that he, Beharee Mullah, and Jewlall, the deceased, had made the acquaintance of a Brahmin at Mozufferpore the day previous; that this same Brahmin met them again in the evening of the same day, while on their way home (eight miles from the town), and induced them to partake of some consecrated rice, or *prasadi;* after eating this he and his friend Jewlall walked a short distance, when they felt their sight becoming confused and dim; they then became giddy, and sat down under a tree, when they groped about the ground until they became quite unconscious. Twelve hours after, he, Beharee, awoke, feeling as if he had been drunk, but neither he nor his friend had taken any spirits on the previous day; he then felt the body of his friend, Jewlall, and found it was quite cold, as if he had been dead some hours.

The Civil Surgeon made a post-mortem examination of the body of Jewlall; a quantity of boiled rice was found in his stomach, which was forwarded to Calcutta for examination; on examining this partly digested rice, several roundish, flattened, kidney-shaped seeds, of a yellow colour, and measuring about a quarter of an inch in their long diameter, were found mixed with it; after careful examination, some of these were found to be seeds of the common capsicum (capsicum frutescens), and others of the common or white dhatoora. These two seeds, differing so greatly in their therapeutical effects, belong to two plants which are, botanically, very nearly allied; they have therefore many characters in common, and are constantly mistaken the one for the other, not only by the poor victims of the poisoner, but also by many others who have not carefully studied and compared them. The one great distinguishing feature above all others is the form and shape of the embryo. If one of each of the seeds be divided by cutting parallel with the flattened sides, the embryo of the capsicum will be found curved like the figure 6, while the end of the curve in the dhatoora is "twisted" or re-curved, not towards the downstroke of the 6, but away from it, or towards the right hand. There are, however, many minor differences of great importance when taken together; these may be contrasted thus:—

| *Seeds of the common or white dhatoora.* | *Seeds of the common capsicum.* |
|---|---|
| 1. Almost kidney-shaped, but one end much smaller than the other. | 1. Kidney-shaped. |
| 2. Outline angular. | 2. Outline rounded. |
| 3. Size, rather more than a quarter of an inch long, and rather less in width. | 3. A little shorter and wider than the dhatoora. |
| 4. Colour greenish-brown when fresh, changing to yellow when dry. | 4. Yellow. |
| 5. Attached to the placenta by large white fleshy mass, which separates easily, leaving a deep furrow along half the length of the concave border of the seed. | 5. Attached to the placenta by a thin cord from a prominence on the concave border of the seed. |
| 6. Surface scabrous, almost reticulate, ex- | 6. Uniformly scabrous, the sides being |

| | |
|---|---|
| cept on the two compressed sides, where it has become almost glaucous from pressure of the neighbouring seeds. | equally rough with the borders. |
| 7. Convex border thick and bulged, with a longitudinal depression between the bulgings caused by the compression of the two sides. | 7. Convex border thickened, but uniformly rounded. |
| 8. When divided into two, by cutting with a knife placed in the furrow on the convex border, the testa is seen irregular and angular in outline, the embryo is seen lying *curved* and *twisted* in a fleshy albumen. | 8. When similarly divided, the testa is more uniform in outline, the embryo is seen lying in a fleshy albumen *curved*, but not twisted or re-curved. |

Having separated the dhatoora from the capsicum seeds by the above physical examination, the following chemical and physiological tests may be applied for confirmation.

The seeds may be separately boiled in a little water and the decoction filtered through blotting-paper. Both decoctions will appear a little turbid, and the dhatoora seeds will have become rather darker in colour by boiling, while the capsicum seeds either retain their bright yellow hue or become a little paler.

| *Chemical tests.* | *Dhatoora decoction.* | *Capsicum decoction.* |
|---|---|---|
| 1. Sol : Perchlor : Iron. | No change. | White cloud. |
| 2. ,, Chloride Gold. | Faint cloud. | No change. |
| 3. ,, Bichlor : Platinum. | Faint cloud. | No change. |
| 4. ,, Ferrocyan : Potassium. | Faint cloud. | No change. |

| *Physiological tests.* | *Dhatoora decoction.* | *Capsicum decoction.* |
|---|---|---|
| 1. Taste. | Insipid. | Pungent. |
| 2. Dropped into the eye of man, cat, or dog. | Causes dilatation of pupil. | No change. |

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The above case is one of the simplest forms of dhatoora poisoning, in which only the simplest means of detection are required. Wherever seeds presenting the three following characters are detected, I believe it may be positively stated they are dhatoora seeds, *viz.* :—

1. *External form.*—From two to three lines

long, and two lines broad, kidney-shaped, with one end much smaller than the other; or perhaps rather in shape like a flattened pear, with one border of the small end convex, the other concave. When the seed is fresh, an angular, white, fleshy *aril* is attached to the concave border; when old and dry, this becomes broken off, its place of attachment being, however, still marked by a rough, rugged, triangular depression or furrow. The whole *testa* or covering of the seed has a scaly or scabrous appearance to the naked eye; on the sides, however, which have been flattened by compression, this roughness is almost obliterated; the same compression has bulged the convex border into two rounded shoulders with an intervening depression.

2. *Internal structure.*—If the seed be equally divided by placing a knife in the above-named depression, and cutting parallel to the flattened surfaces, each cut surface will present a mass of white fleshy albumen, in the midst of which will be seen a *curved*, *twisted*, and *recurved* embryo. This peculiar character of the embryo is characteristic of the genus dhatoora. The rudest diagram would perhaps convey a better notion of it than a mere verbal description; some conception, however, may perhaps be formed of it by imagining a figure 6 to have been seized at its curved extremity, and twisted until its point

became nearly parallel with the commencement of the down-stroke of the same figure, making it something like the neck of a swan in shape.

3. *Physiological action.*—One drop of a decoction of the seed put into the eye of a cat causes well-marked dilatation of the pupil. All three of the above characters apply equally to the only forms of dhatoora commonly found in the plains of India, viz., *datura metel, commonly called white* sada dhatoora, to distinguish it from the other common variety named *datura fastuosa*, commonly called black kala dhatoora, from its dark leaves. The two latter characters, as well as the peculiar structure of the *exosperm* which gives rise to the scabrous appearance of the surface, are, however, common to all the species of dhatoora, and, taken together, would be absolutely characteristic.

The only other species of dhatoora found in India is the *datura ferox*, which has small, black, kidney-shaped, scabrous seeds. It is found on the Malabar coast. The ordinary medicinal plant, *viz.*, datura strammonium, has very similar small black seeds; the surface of these is, however, quite *reticulate* as well as *scabrous.*

In the North-Western Provinces, the ordinary food of the people is wheat flour, made into unleavened cakes, called chupatties. Whole dhatoora seeds could not conveniently be clandestinely administered with these; it is therefore common in those parts to find that the poisonous seeds have been ground before being used for drugging purposes. The testa of dhatoora seeds being tough rather than brittle, is not very easily reduced to fine powder; when, therefore, it is mixed with flour, it appears as small brownish-yellow particles scattered through the white mass; this appearance alone would give rise to suspicion in any country where sifted flour is ordinarily used; but in India, where the flour in common use is always mixed with bran, their appearance to the naked eye is not sufficiently dissimilar to excite any remark.

The following case affords a good illustration of this class of dhatoora drugging or poisoning:—

On the 24th January, 1866, two patients were brought to the Chupra Dispensary suffering from the following symptoms:—chattering delirium, with a tendency to perform strange antics; they were stupid and unintelligible; their pupils were widely dilated; their skin was of a natural temperature; pulse quick and small; tongue white and moist. They both recovered under appropriate treatment. On subsequent inquiry, it was found that these curious symptoms supervened rapidly after eating chupatties made of flour, some of which was still found by remaining.

This flour was thus examined:—

First, it *was sifted*, to separate all the coarser particles; these were then examined with the aid of a pocket lens. The grinding in this case had been so carelessly performed that whole kernels of dhatoora seeds were found, recognizable by the peculiar twisted and curved embryo above described; these kernels were scattered in a larger mass of broken seed-coverings (testæ) of both wheat and dhatoora; fortunately, these two are so utterly different in structure from each other that no difficulty is experienced in distinguishing and separating them. In each case the testa is composed of three distinct layers or coverings, but, for present purposes, our attention may be confined to the outer layer or exosperm. This, in in the case of wheat, is a smooth, thin, dense, solid layer, of equal thickness throughout; it is made up of flattened cells placed horizontally, or parallel with the surface of the seed; while in the case of dhatoora it is made up of round open tubes, or pipes placed perpendicularly to the surface of the seeds' surface. In the compressed portions these tubes are somewhat shortened, but in all the parts where their development has not been interfered with by pressure of the surrounding seeds, they are long, wavy, and lie parallel to each other. It is the open mouths of these tubes which give the surface of the seed its scabrous appearance; the exosperm of dhatoora further contrasts with that of wheat in being rough, thick, light, and friable, and of unequal thickness in its entire extent. It is scarcely possible for a person accustomed to examine ground dhatoora seeds with a lens to be unable to distinguish the peculiar characters of the dhatoora exosperm from any other known structure, unless it is ground very fine: fortunately, however, the physiological test above described is so easily applied for confirmation that dependence need never be placed on the physical characters alone.

Cases, however, do occur where the dhatoora has been ground so carefully that the closest observation fails to detect the peculiar structure; if in these cases the seeds or testæ have not been soaked long or boiled much, a decoction of them dropped in a cat's eye will afford all the additional evidence required for confirmation; if, on the other hand, the seeds have been so macerated that most of their active principle is abstracted, a more minute chemical analysis will be required.

In cases of suspected poisoning by dhatoora, where the most careful examination of the contents of the stomach by repeated washings and decantations fails to detect any portion of the seed sufficiently large to be recognized by the morphological examination above described, or where the portions so discovered have been already so long macerated that the active principle (daturia) has become generally diffused throughout the whole mass, so that a decoction of them fails, when applied, to dilate the pupil of a cat's eye, a more extended and elaborate process will be necessary.

Details of the process adopted in the following case afford a good illustration of what appears to be the best mode of procedure in the present state of our knowledge. Though this was a case of poisoning by the accidental eating of dhatoora leaves, no difference in the process now under consideration was required, the object being equally in both cases to present the alkaloid in a concentrated form, and separated as far as possible from all extraneous matter, for the application of physiological, chemical, and other tests.

In March of the present year, somewhere near Midnapore, father and mother, with their children, cooked and ate some "greens" or *sag* which they had gathered, supposing it to be edible. The parents both died, but the children recovered, and afterwards pointed out where the supposed *sag* was gathered. It was then discovered they had eaten some young shoots of the dhatoora plant. The stomachs of the deceased, having been sent to Calcutta, were subjected to the following process. The contents of the first being removed, the stomach itself was cut into small pieces; these contents and pieces were then placed together in a bottle with some proof spirit acidulated with acetic acid, where they were allowed to macerate for three days, after which the fluid portion was separated from the solid by filtration, and the filtrate evaporated to dryness on a water-bath. The dry mass so obtained was next treated with rectified spirits of wine, in order to extract the active principles, and at the same time to coagulate the albuminoid, gummy, and other bulky substances; these were separated by filtration, and the filtrate was again dried on a water-bath. This process of purification was twice repeated, the first time with rectified spirits, the second with absolute alcohol. In this way the bulk of the mass was very greatly reduced, and yet, at the same time, the whole, or almost the whole, of the alkaloids present in the original mass were extracted and gathered together in a concentrated form in the dried mass on the water-bath. This essence was now dissolved in a little water, and injected into the stomach of a puppy; vomiting unfortunately occurred almost immediately; enough, however, was retained to show the characteristic symptoms, as will be presently seen. In the meantime it should be remarked that, in order to avoid this inconvenient rejection of the matter given, very careful purification is necessary; whenever this cannot be sufficiently done by repetitions of the process above described, the extract so obtained should be rendered alkaline by carbonate of soda, and the whole shaken frequently with three or four times its bulk of ether, for a period of thirty-six hours; by this operation most of the alkaloids, together with the fatty matter, will be extracted by the ether, and may be obtained by pouring off that fluid and allowing it to evaporate spontaneously. The presence of another similar stomach in reserve made it unnecessary to adopt this precaution in the present case.

Very soon after the above-mentioned vomiting, the puppy performed a few antics, and fell over on his side into a deep sleep, from which tickling failed to rouse him; after ten minutes he got up, stared wildly about him, and appeared to see visions which he would scratch or snap at; finding, however, that they eluded him, he walked to his accustomed corner of the room, where he lay down and remained somewhat restlessly; at this time his pupils were much dilated; he did not again fall asleep, but moved constantly from one side to the other of his little corner; sometimes his eyes were closed, when he appeared to be in a restless slumber, disturbed by low moans. A little later he appeared more drowsy and sleepy, but he still opened his eyes when his name was called. The pupils continued widely dilated all this time. Half an hour later he was placed in the middle of the room, when he staggered towards his corner again, his feet and legs bending under him as he went, as if he had lost almost all power over them. When any part of his body was pinched with a pair of forceps, he screamed and turned his head towards the injured part. Half an hour later again, he, being still in his corner, looked very drunk, and performed such antics as a drunken beast might do. By evening, *i. e.*, after six hours, he had almost recovered, but the pupils were exceedingly dilated, and they continued more or less so the whole of the next day.

The remaining stomach and its contents were treated in a manner precisely similar, including, however, the additional purification with ether, and the result was submitted to examination by chemical and microscopical tests; as, however, the above succession of symptoms, reproduced in the dog, were considered to afford satisfactory evidence that portions of some plant belonging to the natural order Atropaceæ were contained in the suspected stomach, it was desirable to defer the consideration of the chemical tests until the physiological evidence had been more carefully examined.

In September of the present year another case occurred in the Midnapore district which is well worthy of attention. A Sub-Inspector of Police was for some cause placed in custody, and died while he was in the lock-up. It was reported that he had taken opium, and the stomach was forwarded to Calcutta for examination; on its arrival, the whole contents were subjected to a careful physical and mechanical examination. No smell or appearance of opium could be detected, but particles were found which had the appearance of ground dhatoora seeds; a decoction of these particles, however, failing to dilate the pupil of a cat's eye when dropped into it. The examination was thus proceeded with. A portion was examined in the usual way for opium, but none was found.

Next, the absence of any metallic poison was ascertained by Reinsch's and the Magnesium tests; afterwards the whole remaining contents, as well as the stomach itself, were submitted to the modification of Stas' process, described in the foregoing case. The resulting extract was equally divided, the first half being tested for narceine,* morphine, and meconic acid without any success, and the remaining half being given to a kitten at noon on the 27th September. The little cat soon began to breathe with difficulty, and to froth at the mouth; in ten minutes her pupils were dilated, and they continued to remain so, only to a still greater extent, the rest of the day, never for a moment being contracted, or even less dilated, when exposed to a strong sunlight. After 20 minutes she was placed in the middle of the room, and encouraged to walk, but she staggered and fell on attempting to do so. In half an hour from the time of administration, she was quite unconscious; up to this period she had felt pain when pinched with a forceps, but now a severe pinch only caused a slight movement of the limb, without any expression of pain. The respiration was still laboured; she continued to froth at the mouth, and the pupils remained very widely dilated. Consciousness began to return at two o'clock; she then got up, sat staring wildly, and commenced to perform a series of grotesque actions, uttering a low moan from time to time. When pinched, she felt pain, but not yet very acutely. She appeared very irritable, almost wild, but was neither vicious nor bad-tempered. At 3 p.m. the pupils were dilated extremely, the iris being a mere thread. By 4 p.m. she had recovered so far as to be able to come when called, and to feel acute pain when pinched, the pupils continuing as large as ever.

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* Narceine is very abundant in Indian Opium, and is readily indicated by the deep purple colour produced when treated with free mineral acids.

A small portion of the same extract or essence was applied to the eye of another kitten; it caused the pupil to dilate in half an hour; another portion of the same was applied to the experimenter's lip, without producing any numbness.

In reporting the result of this examination, it was stated that no opium could be detected, but that a portion of an extract, or essence, of the stomach and its contents, when given to a kitten, produced such a concatenation of symptoms as could only have resulted from the administration of one of the plants belonging to the natural order Atropaceæ, and that the particular one was probably a species of dhatoora.

The only other order of plants capable of producing symptoms likely to be mistaken for the above is the Ranunculaceæ. The genus aconite, belonging to this order, being perhaps the most frequently used vegetable poison in India, except dhatoora, it is necessary that the symptoms produced by each should be carefully compared and contrasted, that the characteristics of each may be clearly defined. The following memoranda of cases are taken from the records of the Chemical Examiner's Office.

### Case I.

A Police Constable at Brahmabaria, in Zillah Tipperah, was suddenly taken ill on the 20th of August last with burning pain in the epigastrium, frothing at the mouth, great restlessness, and inability to speak freely; his limbs soon became cold, and his pulse is reported to have been very weak. No mention was made in the report of the existence or non-existence of paralysis. The patient said somebody had administered poison with his *pan*,* when asked to account for his illness. He died in about four hours. On examining his body after death, a piece of root was found in his stomach, which was pronounced to be aconite root, on the spot; it was, however, forwarded to Calcutta, where it was further examined in the following manner. After being cut into small pieces, it was macerated in spirit for 24 hours; a few drops of this tincture was next administered to a kitten with the following results. After half an hour her pupils were slightly dilated, though they became smaller when she was held towards the light to be examined; at this time, also, she made violent efforts to vomit, but only small portions of the contents of the stomach were ejected. After this she became very restless, walked about the room, seeking means of escape; not finding any, however, she returned to her original corner, where she sat staring vacantly, with head erect and pupils more widely dilated. After a few minutes she moved again about the room, not showing any marked signs of loss of power over her limbs. When her tail or foot was pinched with a pair of forceps, the limb was suddenly drawn up; but when the skin of the back was similarly seized and forcibly twisted, she neither showed any sign of pain, nor made any effort to move away; the feelers could even be pulled without exciting any appearance of displeasure. After the lapse of 45 minutes, she was more inclined to sit still, or lie as if sleeping;

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* Pan is a preparation of catechu, lime, and betel pepper, commonly chewed after meals by the natives of India.

when called, however, she always opened her eyes and looked, showing at the same time her dilated pupils. After an hour and a half all these symptoms gradually began to disappear.

A little of the same tincture which was applied to the lip of the experimenter caused numbness, which continued more or less for 24 hours.

The above signs and symptoms were considered sufficiently characteristic to confirm the suspicion that the root was aconite.

### Case II.

At Ranchee, in February of the present year, a man was suddenly seized with severe illness, after drinking some rice-spirit, and died the same day. No symptoms appear to have been recorded, but there was a suspicion of poisoning, and the stomach, with its contents, was forwarded to Calcutta for examination. They were first examined for mineral poison by Reinsch's and the Magnesium tests; none being found, the contents were next submitted to a careful physical examination, but no known poisonous substance was detected by this means; the whole stomach and contents were therefore subjected to the modification of Stas' process, above described. The resulting extract was divided into two equal parts, one of which was injected into the stomach of a puppy at 10 a.m. on the 22nd of February. His pupil became dilated in a few minutes; he also began to froth in the mouth, and to lose power over his hind legs. He continued quite conscious, always looking up when called; his pupils were generally dilated, but close and continued observation revealed much variation in their size; they were often contracted to about their normal size for a moment or two, but never absolutely small. At one o'clock he was brought out of his corner and placed in the middle of the room; he then attempted to walk back again, but walked with a tottering gait, his hind legs springing up again, in a state of great irritability, as soon as the feet touched the ground. When one hind foot was pinched with a pair of forceps, such violent reflex actions were produced that he immediately fell heavily to the ground towards the pinched side. His pupils were still dilated. No expression of pain was made when he was pinched severely in any part of his face or body. At 2 p.m. he lay apparently asleep, but raised his head and looked up the moment he was called. From this time he gradually recovered, and by the next morning was quite well.

A little of the remaining portion was rubbed on the experimenter's lip at noon; by 3 p.m. the part had become so benumbed that the point of a needle was not felt when applied.

The peculiar action on the pupil, together with the insensibility to pain, caused by the suspected substance in the above case, were considered, in the absence of other signs, sufficiently characteristic to justify the opinion that aconite, or some nearly allied poison, existed in the suspected stomach.

## CASE III.

At 11 p.m. of the 8th of August, 1865, one Choonee Ghazee, a resident of Tipperah, became very ill immediately after eating his evening meal. He is reported to have felt numbness over his whole body, and to have lost all strength; to have vomited frequently up to nine o'clock on the following morning, and to have died at noon on that day. At the post-mortem examination, the stomach was found congested, but quite empty; it was put into a bottle with some spirit, and forwarded to Calcutta for examination. One spirituous fluid was prepared as above described by repeated evaporations, solution, filtration, and re-evaporation, and the resulting extract, or essence, was divided into two unequal parts; the larger of these was injected into the stomach of a small cat; much, however, was lost by the struggling of the animal, and more was vomited within two minutes from the time it was given. After a lapse of five minutes, the following symptoms were seen: her pupils began to dilate, her breathing to be laboured, and her hind legs became so paralysed that she could scarcely walk, her hips falling to the ground from side to side as she attempted to do so. A little later she could not support the weight of her hips, but squatted down and pushed herself about by the fore-legs. Violent efforts to vomit were made from time to time, but only a little frothy matter was ejected. When pinched with tweezers in different parts of the body, no signs of pain were made. She appeared restless and distressed, staring wildly about, the pupils being more dilated. In half an hour from the time of administration, she began to lose power over her fore-legs also, and after an hour she had become quite still and motionless, and perfectly insensible to pain. At this time her pupils varied much in size; towards one o'clock, or two hours from the commencement, they were contracted rather than dilated. From this time she began to recover her normal condition.

The smaller portion of the extract was applied to the lip of the experimenter without inducing any decided numbness; it was also tested chemically.

The results of this examination were not considered sufficiently satisfactory at the time to justify a confident opinion that aconite was contained in the stomach; when, however, the symptoms of the patient are considered in conjuntion with those reproduced in the cat, it is scarcely possible to doubt that aconite was the cause of death.

Case IV. occurred recently in Calcutta. A woman was reported to have died in a little more than two hours after taking some laudanum to destroy herself. A post-mortem examination was made by the Police Surgeon, and the stomach, two-thirds filled with food, was forwarded to the Chemical Examiner's laboratory for examination. An extract, or essence, of the whole having been prepared by the above described modification of Stas' process, was divided into two equal parts. One part was examined for narceine, morphine, and meconic acid, but neither of these substances could be detected. Half of the remainder was therefore injected into the stomach of a kitten at noon on the 4th October; at 15 minutes past 12 the pupils of her eyes became dilated, remaining so for the space of half an hour; after this time they varied in size, were generally dilated, sometimes very widely, but never greatly contracted; she moaned uneasily from time to time; at a quarter to one she began to foam at the mouth, quantities of saliva flowing out. No sign of pain was made when her lips were pinched, or her feelers pulled with forceps. She remained in her corner, staring vacantly and moving constantly from side to side, as if very uneasy. When brought out and placed in the middle of the room, she walked back to her corner with a tottering gait. These signs and symptoms continued to increase till 1·30 p.m., after which time they gradually passed away; at 2 o'clock she was, however, still insensible to the pain of pinching, and her pupils were still more or less dilated. The remaining fourth of the essence was reserved, part of it being applied to the lip of the operator, when it produced the characteristic numbness, and part being submitted to chemical and microscopical tests.

On reviewing the several symptoms produced in the cat or dog by these two poisons, *viz.*, dhatoora and aconite, it will be observed that some are constant, while others are variable; that some are common to both poisons, or so nearly resemble each other that they may be easily confounded; while others are peculiar to, and characteristic of, one only. The more marked symptoms may now be examined in detail.

1. *Dilatation of the Pupil.*—This symptom is common to both poisons; there is, however, such a well-marked difference in the action of the two, that this one symptom alone, carefully observed, might suffice for a differential diagnosis. When dhatoora is taken, the pupil enlarges gradually and continuously until the iris is seen as a mere narrow band or thread; it remains in this condition, without varying, for many hours, no exposure to light causing any contraction; when, on the other hand, aconite has been taken, both the cervical sympathetic and the third nerve appear to be thrown into a state of excitement and irritability, the latter being the more paralyzed (or less excited, as the case may be) of the two; for while the pupil is generally dilated to a certain extent,

the dilatation is scarcely ever so extreme as in the case of dhatoora; it manifests, moreover, a constant tendency to vary in size; thus, while the animal is at a distance from the observer, it may be seen much dilated; while, however, it is being watched, limited contractions will be seen to take place. If the animal is brought near, and its eye manipulated in a bright light for more minute inspection, these contractions may proceed to such an extent that it becomes doubtful whether there is any dilatation at all. Sometimes, as in Case II., contraction to this extent, or even more, may take place without any manipulation or exposure to light.

2. *General Paralysis* is also a symptom common to both, though generally less marked in the case of dhatoora. When complete, there is doubtless some difficulty in distinguishing between the two forms; but in the less complete stages there are marked differences. In the case of dhatoora there is an absence of the co-ordinating power, together with inability to sustain any continued series of volitional efforts, which gives the animal a drunken appearance; this appearance is greatly heightened by the curious antics which are played, which antics appear to be partly the result of spectral illusions, and partly of the awkward and misdirected efforts to attack the spectres. The paralysis of aconite is less constant in its mode of development. The hind legs

appear to be attacked first in most cases, and the first sign appears to be an exaltation of the natural reflex actions; if at this time the sole of the foot is pinched or irritated, the excitement produced in the reflex spinal centre appears to be so strong as to destroy, for the time, all volitional power, and the animal falls to the ground on the irritated side.

3. *Insensibility to Pain*, when any portion of the skin is pinched with a forceps or pricked with a pin. This is the great characteristic symptom of aconite poisoning; it is marked and decided, while the animal remains perfectly intelligent, and able to move about freely. It occurs also in poisoning by dhatoora, but not to any extent until the animal has lost all consciousness and power of motion.

4. *Loss of Consciousness.*—This symptom occurs to a limited extent in all cases, however slight, of dhatoora poisoning, but it is only observed after aconite, when a large dose has been taken, or for a very short time, when the symptoms of a smaller dose are at their height.

The other symptoms are less constant, and the distinction between those produced in the two cases less clearly defined. Difficulty of breathing is common to both. Frothing at the mouth also occurs in both; but the free and abundant flow of saliva is more marked in aconite poisoning than in the other, and depends probably on the insensibility of the lips; the saliva in contact with them is not felt, therefore no effort is made to swallow it. There is a peculiarity in the vomiting after aconite which may help to confirm the diagnosis; violent efforts are made to empty the stomach with very little result; all the signs, however, connected with this symptom depend so much on the state of purity or impurity of the prepared extract, that they can only be regarded as auxiliary aids.

The distinguishing characters of the physiological symptoms produced by these two poisons may be thus summed up and contrasted:—

| Dhatoora. | Aconite. |
|---|---|
| 1. Dilatation of the pupils, which increases until the iris is a mere thread. Limited and irregular contractions do not take place while the influence of the poison continues; when this passes away, the pupil gradually resumes its normal form. | 1. Dilatation of the pupil, with a constant tendency to limited contractions, which may be increased by exposure to light. The dilatation may give place to contraction while the influence of the poison is at its height. |
| 2. The paralysis is that of a drunken animal, and is always associated with impairment of the mental powers. | 2. Paralysis generally commences in the posterior extremities, and may be extreme without any apparent impairment of intellect. |
| 3. Insensibility to pain, when pinched, does not occur until the animal is unconscious of everything around. | 3. Insensibility to pain is an early symptom, and may be extreme while the intellect and power of locomotion are still unimpaired. |

The means of distinguishing and recognizing dhatoora seeds, when discovered either whole or in coarsely ground fragments, have now been described. The physiological action of dhatoora, and of the atropaceous order generally, has also been contrasted with that of aconite; this latter being the only common poison which is known to share with atropaceous plants the power of dilating the pupil when applied to the eye, or to be capable of producing symptoms, when injected into the stomach of a kitten, which could be mistaken for those produced by dhatoora and its allies. The respective actions of these two poisons on the animal economy appear to be sufficiently characteristic, whenever they can be administered in any appreciable quantity, not only to detect the poisons themselves, but also to distinguish them from each other. This subject would, however, still remain incomplete, unless some attention were bestowed on the chemical tests which have been recommended from time to time; I therefore propose to detail briefly the result of some experiments made by me with a view to ascertain the amount of aid which may be expected from chemistry in the cases under consideration. It is customary in medico-legal text books to describe the physical and chemical characters of the several poisonous alkaloids in a state of crystalline purity. As, however, I have never been able to obtain, in any actual case of poisoning which has come under my notice, even a microscopical quantity of the alkaloid in this pure condition, it will only be necessary, in a purely practical paper like the present, to allude to those tests which can be applied when the alkaloid has been as completely as possible separated from all extraneous matter. To effect this, I would recommend the following process to be adopted in all cases of poisoning, where there is reason to believe either aconite or any plant of the atropaceous order has been employed. The stomach, after being cut into very small pieces, should be placed in a bottle with proof spirit slightly acidulated with acetic acid; the contents of the stomach, having been previously submitted to a careful physical examination, should be mixed with rectified spirit, and placed in a separate bottle with a few drops of acetic acid; both bottles should then be set aside to macerate for twenty-four hours, after which the spirit should be filtered from each into a third bottle, and a fresh supply added, as before, which should in its turn be also filtered off after a period of twenty-four hours. Three such macerations will suffice to separate any alkaloid. The several portions of filtered spirit, having been mixed together, should now be evaporated in a basin of wedgewood-ware, the first two-thirds on a sand-bath, the last third in a water-bath. The somewhat bulky residue should, when cold, be gradually and carefully mixed with rectified spirit, until a uniform pasty mass is obtained, after which a larger quantity of rectified spirit should be suddenly added; this will precipitate much of the bulky matter, and retain the alkaloids in solution; this solution should be filtered, re-evaporated to dryness in a water-bath, and the residue so obtained be again treated with rectified spirit, filtered and evaporated as before. If the resulting residue appears to contain much fatty matter, it may be boiled with a little distilled water acidulated with acetic acid; this mixture should then be similarly filtered and evaporated on a water-bath. The residue may be further purified by being treated once or twice in a similar manner with absolute alcohol instead of rectified spirit. Finally, the residue should be rendered neutral or faintly alkaline by the addition of a weak solution of carbonate of soda in distilled water, and shaken violently for half an hour, with three or four times its bulk of ether, in a well-corked bottle; this ether should then be poured off into a small evaporating dish, and replaced by a similar quantity of fresh ether, which after three hours should in its turn be poured off into the same dish, replaced by a third supply, and allowed to remain for twenty-four hours, after which it should also be poured into the same dish, and allowed to evaporate spontaneously. The residue thus obtained should be treated with warm distilled water, slightly acidulated with acetic acid, and filtered to separate it from any remaining fatty or resinous matter; the filtrate so obtained will contain an acetate of the alkaloid sufficiently free from impurities to be tested physiologically and chemically. In the first place, a small quantity should be applied to the eye of a kitten; if, after a period varying from half an hour to two hours, it has caused dilatation of the pupil, it may be considered highly probable that the suspected stomach contained either aconite or one of the atropaceous order of plants; practically, it may be assumed that either belladonna, dhatoora, or aconite was present; for hyosciamus, the only other commonly used genus of the atropaceous order, is seldom employed as a poison. The alkaloids atropia and daturia are now generally considered to be identical; the production of dilatation of the pupil therefore affords tolerably good evidence of the presence of either aconitia or the alkaloid which is supposed to be common to belladonna and dhatoora. A little of the solution rubbed on the delicate skin on one side of the lower lip, will, if aconite be present, produce such a diminution of its sensibility to pain, that a very decided difference will be appreciable when the point of a needle is pressed upon the part so rubbed and the corresponding part of the opposite side. This is in most cases sufficiently characteristic of the presence of aconite, as the other alkaloid would not give rise to such numbness if rubbed on in any quantity. Further evidence may, however, be obtained by injecting the solution into the stomach of a kitten or puppy, as in the cases quoted above. The further aids I have been able to obtain from chemical tests, have not been sufficiently constant or satisfactory to enable me to place confidence in them in any case; yet, as they may afford a certain amount of collateral evidence, they should be applied whenever a sufficient amount of the poisonous matter can be obtained, in addition to that required for the physiological tests.

In the following chemical experiments, I would premise that the several solutions tested were made by the above described modification of Stas' process, from aconite root, dhatoora seeds, and extract of belladonna; and also that the presence of the active principle in the solutions was in every case ascertained by the above-named physiological tests before the chemical reagents were added.

The chemical tests which have been examined are the iodo-hydrargyrate of potassium, sulphuric acid, bichloride of platinum, chloride of gold, picric acid, and tannic acid. The first of these, *viz.*, the iodo-hydrargyrate of potassium, is made by carefully adding a solution of bichloride of mercury to a solution of iodide of potassium, until the precipitated biniodide of mercury is no longer re-dissolved. A little of the so formed solution is generally described as capable of precipitating *any* of the alkaloids from their solution; if, therefore, no precipitate was caused by this re-agent in a solution prepared as above, it would not appear unreasonable to conclude that no alkaloid was present. I, however, feel able to state from repeated observations that a solution prepared as above described from the seeds of dhatoora, may be sufficiently strong to cause dilatation of the pupil in twenty minutes, and yet produce no precipitate when treated with the iodohydrargyrate of potassium; the unsatisfactory character of this test, however, arises from the fact that it does sometimes cause a distinct yellowish-white precipitate in the dhatoora solution. I have frequently observed that if this re-agent be applied *immediately* after the residue of the etherial solution has been dissolved in acidulated water, a precipitate will be formed; while, if the same solution is allowed to stand a few hours, it no longer gives a precipitate with the re-agent, though it still retains the power of dilating the pupil. The same re-agent always produces a similar yellowish-white precipitate in solutions prepared from extract of belladonna; it also always produces a more abundant cream-coloured curdy precipitate in solutions prepared from aconite. It has been said that these several precipitates may be distinguished from each other under the microscope. I have been unable to confirm this statement: the test tubes containing the several precipitates, after being allowed to stand for twenty-four hours, present different appearances to the naked eye, but when a little of the precipitate is examined under a magnifying power of about 200 diameters, it appear to be resolvable, in each case, into minute, transparent, spherical granules, remarkably uniform in size, but more or less aggregated, in proportion to the amount of precipitate present. To the naked eye, the precipitate, in the case of aconite, appears as a flocculent cream-coloured curdy mass, gently floating in the lower portions of the liquid; in the case of dhatoora and belladonna, the smaller quantity of precipitate not only subsides entirely, but also becomes adherent to the bottom of the tube, and has a rather bright yellow colour when looked at from below.

If a solution of sulphate of atropia, in the proportion of one grain to an ounce of water, is treated with the same re-agent, the precipitate formed presents precisely the same appearances to the naked eye; but when examined microscopically, a number of bright yellow scaphoid crystals will be seen lying in the midst of the spherical granules. If similar crystals could be obtained from small quantities of dhatoora seeds or belladonna, treated as above described, this would be sufficiently characteristic to distinguish them from aconite in any case which would occur in practice. I have, however, only been able to obtain them when the pure alkaloid itself was used.

The next test which has been described as capable of distinguishing atropia or daturia from aconitia, is boiling sulphuric acid. This is said to produce a brown colour and suffocating fumes with aconite, while with atropia it gives rise to a pink colour and a sweet odour. In the minute portions which have to be operated upon in actual practice, I am afraid this test would not afford much help where any doubt previously existed; the presence of any organic matter will give rise to a "dark brownish colour," and fatty matters will cause "suffocating fumes." More stress has, however, been laid on the usefulness of bichloride of platinum to distinguish between solutions containing aconite and atropia. A chemist and toxicologist of such experience as Professor W. Herapath appears to state in a contribution to No. 3, Vol. VII. of the *Pharmaceutical Journal*, that solutions of atropia may be distinguished from those of aconite by the chloride of platinum; this re-agent causing a precipitate when atropia is present, but none with aconite. Again, in a little book lately published as "The Toxicologist's Guide," I find that the non-precipitation by chloride of platinum, when added to a solution of an alkaloid, is considered to be characteristic of aconite. If these statements could be confirmed in actual practice, this re-agent would afford a very valuable aid in the cases of poisoning under consideration. I am, however, obliged to consider this test as utterly useless and unreliable, as will be presently shown. The fact is that the alkaloids are complex bodies which are liable to undergo great and rapid changes; it appears probable from analogy, and also from experience, that their chemical properties may vary considerably within certain limits, while their physiological action remains unaltered. This is probable from analogy with the allotropic conditions of non-metallic elements, and with the homologous forms of narcotine which have been investigated; it is further probable from the experience related above, *viz.*, that a solution prepared by Stas' process from dhatoora seeds will sometimes yield a precipitate with iodo-hydrargyrate of potassium, while at other times it will not, both solutions being equally capable of causing dilatation of the pupil. If this hypothesis is accepted, until approved or disproved by the advance of our knowledge of the chemistry of the alkaloids, it will explain why such observers as Herapath and Grove should have stated in the pages of the same journal, the one that aconitia *is*, and the other that it *is not*, precipitated by chloride of platinum. I have before me records of nine applications of this re-agent to solutions of aconite and atropia prepared and tested physiologically as above described; the results in each case are tabulated below:—

*Action of Solution of Bichloride of Platinum on Solutions of Atropia and Aconitia.*

| Solution of Aconitia. | Solution of Atropia. |
|---|---|
| 1. Whitish precipitate. | No change. |
| 2. Dark purple colour, but no precipitate. | Milky precipitate. |
| 3. Ditto ditto. | Ditto. |
| 4. No alteration of colour; flocculent precipitate. | Cloudy-whitish. |
| 5. No colour; no precipitate. | No change. |
| 6. No colour; precipitate after eight hours. | No change. |
| 7. No change. | No change. |
| 8. Precipitate after standing twenty hours. | Cloudy. |
| 9. No colour; no precipitate. | No change. |

The chloride of gold test has appeared to me still more variable and uncertain in its action. The tannic acid test is perhaps more useful, though still unreliable, as it precipitates both aconitia and atropia; the precipitate in solutions of aconitia of similar strength is, however, more abundant than that produced by this re-agent in solutions of atropia.

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